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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/064,624 | 07/31/2002 | John Scott Price | Gem-0033 | 8849 |
| 23413 | 7590 | 03/10/2004 | EXAMINER | |
| CANTOR COLBURN, LLP 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002 | | | HO, ALLEN C | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2882 | |

DATE MAILED: 03/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-----------------|--------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/064,624 | PRICE ET AL. | |
| | Examiner | Art Unit | |
| | Allen C. Ho | 2882 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 and 29-31 is/are rejected.
- 7) ☒ Claim(s) 27 and 28 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 August 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413) Paper No(s). <u>0204</u> . |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>0702</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

1. In response to applicant's telephone inquiry regarding the last Office action, the following corrective action is taken.

The period for reply of ONE MONTH set in said Office Action is restarted to begin with the mailing date of this letter.

2. A corrected copy of the last Office Action is enclosed.

Specification

3. The disclosure is objected to because of the following informalities:

- (1) Page 10, paragraph [0040], line 4, "300" should be replaced by --304--.
- (2) Page 10, paragraph [0041], line 1, "300" should be replaced by --304--.
- (3) Page 10, paragraph [0041], line 2, "300" should be replaced by --304--.

Appropriate correction is required.

Drawings

4. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the subject matter claimed in claims 3 and 14 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

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5. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the subject matter claimed in claim 4 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

6. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, field emission array and Spindt-type field emission array as claimed in claims 8, 9, 18, and 19 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

7. Claim 21 is objected to because of the following informalities: line 4, "the" should be replaced by --an--. Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 2, 12, and 24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not

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described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 2, 12, and 24 recite that the optical energy and the gap energy are pulsed by pulsing the extraction voltage of the power supply. It is unclear what is the extraction voltage of the power supply. There is only a brief reference to the extraction voltage in the specification (page 6, paragraph [0029], lines 4-5). In Fig. 2, the extraction voltage (Vac) is referenced as the gap voltage (226).

10. Claims 8, 9, 18, and 19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 8, 9, 18, and 19 recite an x-ray tube that comprises a photo-cathode and a field emission array. Figs. 5 and 6 show that electrons are generated by bombarding a photo-cathode with an optical energy carried by a waveguide. However, there is no teaching that a field emission array is disposed in the same x-ray tube. As understood by persons skilled in the art, photo-emission and field emission are two different mechanisms for generating electrons.

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 3 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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13. Claims 3 and 14 recite a first power supply and a second power supply. However, it is unclear if these power supplies are part of the power supply recited in claims 1 and 11, or if these power supplies are separate from that power supply, *i.e.*, there are three power supplies. Fig. 2 shows a main power supply (210) that comprises two power supplies (230, 232).

14. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites a power supply configured to provide an anode-to-cathode gap voltage, the anode is referenced to ground potential and the cathode is connected to a negative terminal of a second power supply. It is unclear how the power supply provides the anode-to-cathode voltage if the second power supply provides a negative potential to the cathode.

Claim Rejections - 35 USC § 102

15. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

16. Claims 1, 5-7, 10, 11, 15-17, 20-23, 25, 29, and 30 are rejected under 35 U.S.C. 102(e) as being anticipated by Halavee (U. S. Patent No. 6,324,257 B1).

With regard to claim 1, Halavee disclosed a pulsed power application system for an x-ray tube comprising: an x-ray tube (7) having an anode (8) and cathode (9); a power supply (22) configured to provide optical energy (light) and an anode-to-cathode gap voltage via electrical energy, wherein the optical energy and the gap voltage are pulsed (2, 30) resulting in a pulsed x-ray radiation; and a means for transferring the optical energy (4) and the electrical energy (3a, 3b) from the power supply to the x-ray tube.

With regard to claim 5, Halavee disclosed the pulsed power application system of claim 1, wherein the optical energy is generated by a laser (column 6, line 46-47).

With regard to claim 6, Halavee disclosed the pulsed power application system of claim 1, wherein the cathode includes a surface configured as an electron source to generate electrons triggered by photons directed at the surface, the photons generated from the optical energy (column 6, lines 47-62).

With regard to claim 7, Halavee disclosed the pulsed power application system of claim 6, wherein the surface of the cathode is a photo-emitting surface including at least one of clean metals, semi-conductor crystals, coated metal materials, coated oxide materials, and cleaved crystal edges (column 6, lines 50-58).

With regard to claim 10, Halavee disclosed the pulsed power application system of claim 1, wherein the means for transferring the optical energy and the electrical energy from the power supply to the x-ray tube is a single cable (11), the single cable comprising: a waveguide (4) configured to transfer optical energy to the x-ray tube; an electrical conductor (3a, 3b) surrounding at least a portion of the waveguide along a length of the cable; and an insulating

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material (10) disposed between the waveguide and the electrical conductor, the insulating material surrounding the waveguide and the electrical conductor.

With regard to claim 11, Halavee disclosed an x-ray tube adapted to generate pulsed x-ray radiation comprising: a frame (7); an anode (8) disposed in the frame; a cathode (9) corresponding with the anode disposed in the frame; a power supply (22) configured to provide optical energy (light) and an anode-to-cathode gap voltage via electrical energy, wherein the optical energy and the gap voltage are pulsed (2, 30) resulting in a pulsed x-ray radiation; and a means for transferring the optical energy (4) and the electrical energy (3a, 3b) from the power supply to the x-ray tube.

With regard to claim 15, Halavee disclosed the x-ray tube of claim 11, wherein the optical energy is generated by a laser (column 6, line 46-47).

With regard to claim 16, Halavee disclosed the x-ray tube of claim 11, wherein the cathode includes a surface configured as an electron source to generate electrons triggered by photons directed at the surface, the photons generated from the optical energy (column 6, lines 47-62).

With regard to claim 17, Halavee disclosed the x-ray tube of claim 16, wherein the surface of the cathode is a prepared photo-emitting surface including at least one of clean metals, semi-conductor crystals, coated metal materials, coated oxide materials, and cleaved crystal edges (column 6, lines 50-58).

With regard to claim 20, Halavee disclosed the x-ray tube of claim 11, wherein the means for transferring the optical energy and the electrical energy from the power supply to the x-ray tube is a single cable (11), the single cable comprising: a waveguide (4) configured to transfer

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optical energy to the x-ray tube; an electrical conductor (3a, 3b) surrounding at least a portion of the waveguide along a length of the cable; and an insulating material (10) disposed between the waveguide and the electrical conductor, the insulating material surrounding the waveguide and the electrical conductor.

With regard to claim 21, Halavee disclosed a method to reduce the size for improving the efficiency of operation in x-ray tubes, the method comprising: configuring a power supply (22) to provide optical energy (light) and electrical energy; connecting the power supply to an x-ray tube (7) with a means for transferring the optical energy (4) and the electrical energy (3a, 3b) from the power supply to the x-ray tube, the x-ray tube having an anode (8) and a cathode (9) disposed in the x-ray tube to provide a gap voltage therebetween; pulsing the gap voltage (30); and generating a pulsed x-ray radiation from the anode.

With regard to claim 22, Halavee disclosed the method of claim 21, wherein the means for transferring the optical energy and the electrical energy from the power supply to the x-ray tube is a single cable (11), the single cable comprising: a waveguide (4) configured to transfer optical energy to the x-ray tube; an electrical conductor (3a, 3b) surrounding at least a portion of the waveguide along a length of the cable; and an insulating material (10) disposed between the waveguide and the electrical conductor, the insulating material surrounding the waveguide and the electrical conductor.

With regard to claim 23, Halavee disclosed a pulsed power application system for an x-ray tube comprising: an x-ray tube (7) having an anode (8) and a cathode (9); a power supply (22) configured to provide optical energy generating photons and electrical energy generating an anode-to-cathode gap voltage; a pulsing means for pulsing the photons (2) and the gap voltage

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(30) resulting in a pulsed x-ray radiation; and a means for transferring the optical energy (4) and the electrical energy (3a, 3b) from the power supply to the x-ray tube.

With regard to claim 25, Halavee disclosed a power supply cable for an x-ray tube (7) comprising: a waveguide (4) configured to transfer optical energy to the x-ray tube; an electrical conductor (3a, 3b) configured to transfer electrical energy to the x-ray tube, the electrical conductor surrounding at least a portion of the waveguide along a length of the cable; and an insulation material (10) disposed between the waveguide and the electrical conductor, the insulation material surrounding the waveguide and the electrical conductor.

With regard to claim 26, Halavee disclosed the cable of claim 25, wherein the electrical conductor includes two electrical conductors (3a, 3b) surrounding at least a portion of the waveguide (4), the two electrical conductors configured to optimize a skin effect for pulsed power current transmission through the two electrical conductors (This is inherent. The skin effect is always present and optimized according to the shapes of the conductors).

With regard to claim 29, Halavee disclosed the cable of claim 25, wherein the waveguide includes one of an optical fiber and a bundle of optical fibers (column 7, lines 66-67; column 8, lines 1-3).

With regard to claim 30, Halavee disclosed the cable of claim 25, wherein the waveguide is made from one of a plastic and a glass (column 8, lines 3-5).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claims 3, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Halavee (U. S. Patent No. 6,324,257 B1) as applied to claims 1 and 11 above, and further in view of Farrall *et al.* (U. S. Patent No. 5,008,912).

With regard to claims 3, 13, and 14, Halavee disclosed the x-ray tube of claims 1 and 11. Although Halavee taught that the anode is connected to a high voltage and the cathode is connected to the ground (column 7, lines 24-30), Halavee failed to teach the following configurations: (1) the power supply comprises a first power supply and a second power supply, the anode is connected to a positive terminal of the first power supply and the cathode is connected to a negative terminal of the second power supply, the remaining terminals of the first and second power supply are referenced to ground; (2) the anode is connected to a positive terminal of the power supply, and the cathode is connected to a negative terminal of the power supply.

Farrall *et al.* disclosed an x-ray tube (30) powered by a power supply (12). The power supply comprises a first power supply (42) and a second power supply (44), the anode (32) is connected to a positive terminal (43) of the first power supply and the cathode (34) is connected to a negative terminal (45) of the second power supply, the remaining terminals of the first and second power supply are referenced to ground.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide the power supply according to the above configurations, since a person skilled in the art would recognize that these configurations are equivalent as long as the

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gap voltage, the relative voltage between the anode and the cathode, provides enough potential difference to accelerate the electrons to sufficient kinetic energy to produce x-rays when the electrons impact the anode target.

19. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Halavee (U. S. Patent No. 6,324,257 B1) as applied to claim 25 above, and further in view of Fehre *et al.* (U. S. patent No. 6,418,191 B1).

With regard to claim 26, Halavee disclosed the cable of claim 25. Although Halavee disclosed that the electrical conductor includes two electrical conductors (3a, 3b), Halavee failed to teach that the two electrical conductors are configured to optimize a skin effect.

Fehre *et al.* taught the electrical conductors are configured to optimize a skin effect (column 5, lines 1-15).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the conductors to optimize a skin effect, since a person would be motivated to reduce power loss due to resistance.

20. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Halavee (U. S. Patent No. 6,324,257 B1) in view of Fehre *et al.* (U. S. Patent No. 6,418,191 B1).

With regard to claim 31, Halavee disclosed a method comprising the steps of: employing an optical waveguide (4) to transfer optical energy to an electron source (9) triggered by photon energy to initiate release of electrons; disposing circumferentially (Fig. 4a) an accelerating potential conductor (3a, 3b) about the waveguide; and disposing an insulating material (10) between the conductor and the waveguide, the insulation material surrounding the conductor and a periphery of the waveguide.

However, Halavee failed to teach that the method further comprising the step of: configuring the conductor taking into account skin effect to reduce the thickness thereof.

Fehre *et al.* taught that consideration of the skin effect results in lower use of conducting material (column 2, lines 55-60), producing a flexible and pliable power cable. Furthermore, the low ohmic impedance leads to low losses (column 2, lines 53-54).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the conductor taking into account skin effect to reduce the thickness thereof, since a person would be motivated to produce a flexible cable that minimizes losses in the transmission.

Allowable Subject Matter

21. Claims 27 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

22. The following is a statement of reasons for the indication of allowable subject matter:

With regard to claim 27, the prior art fails to teach or fairly suggest that each of the two electrical conductors is configured as a portion of a cylindrical wall disposed proximate a periphery of the cable to optimize the skin effect as claimed.

With regard to claim 28, the prior art fails to teach or fairly suggest that the electrical conductor is configured to use a transmission line effect of a pulse train of power to maximize voltage at the x-ray tube as claimed.

Conclusion

23. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- (1) Mori (U. S. Patent No. 6,516,048 B2) disclosed an x-ray generator comprising a photo-cathode.
- (2) Dinsmore (U. S. Patent No. 6,480,568 B1) disclosed an optically driven therapeutic radiation source.
- (3) Weisman *et al.* (U. S. Patent No. 6,463,124 B1) disclosed miniature energy transducer comprising a Schottky cathode tip that emits photoelectrons.
- (4) Shinar *et al.* (U. S. Patent No. 6,320,935 B1) disclosed a miniature energy transducer comprising a flexible cable that carries both optical and electrical signals.
- (5) Lovoi (U. S. Patent No. 6,319,188 B1) disclosed an x-ray probe comprising an optical fiber cable with an embedded high voltage conductor.
- (6) Frankeny (U. S. Patent No. 5,793,223) disclosed a transmission line that matches the load impedance.
- (7) Oettinger *et al.* (U. S. Patent No. 5,428,658) disclosed an x-ray source with flexible probe.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allen C. Ho whose telephone number is (571) 272-2491. The examiner can normally be reached at Monday - Friday from 8:00 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached at (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1550.

A handwritten signature in black ink that reads "Allen C Ho". The signature is written in a cursive, flowing style.

Allen C. Ho
Patent Examiner
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ACH